ID-INFORMATIONS-SENDE-/EMPFANGSSYSTEM

Patent number:	DE4204463
Publication date:	1992-08-27
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Classification:	
- international:	B60R16/02; G07C9/00; G08C25/04; H04Q9/00
- european:	B60R25/00; G07C9/00E14C6; G08C23/04
Application number:	DE19924204463 19920214
Priority number(s):	JP19910076006 19910215; JP19910135218 19910513

Also published as:

GB2254461 (A)

Abstract not available for DE4204463

(12) UK Patent Application (19) GB (11) 2 254 461 (13) A

(43) Date of A publication 07.10.1992

(21) Application No 9203209.3

(22) Date of filing 14.02.1992

(30) Priority data
(31) 03076006 (32) 15.02.1991 (33) JP
03135218 13.03.1991

(51) INT CL[5]
B60R 25/00, G07C 9/00

(52) UK CL (Edition K)
G4H HTG H1A H13D H14A H14B H14D
U1S S1720 S1820 S1869

(56) Documents cited
EP 0372285 A1 US 4686529 A

(58) Field of search
UK CL (Edition K) G4H HTG
INT CL[5] B60R, G07C

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(54) Identification information transmitter/receiver system

(57) A transmitter (Fig. 1) transmits fixed I.D. data and variable data depending on the number of operations. A receiver (Fig. 3) checks the data before e.g. locking/unlocking an automobile. If the same correct I.D. data is received three times in succession, even though the respective variable data are incorrect, nevertheless the data will be deemed correct and a jump performed in the record of variable data in the receiver to bring it into step with the transmitter.

FIG. 1

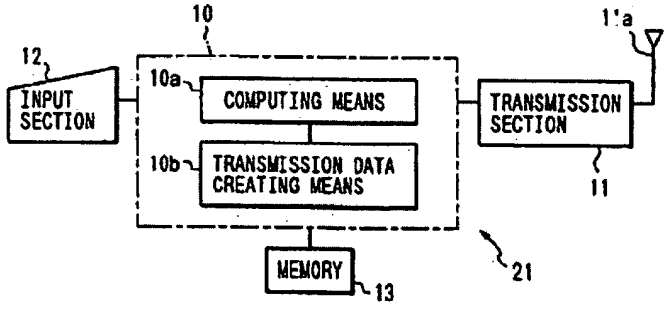
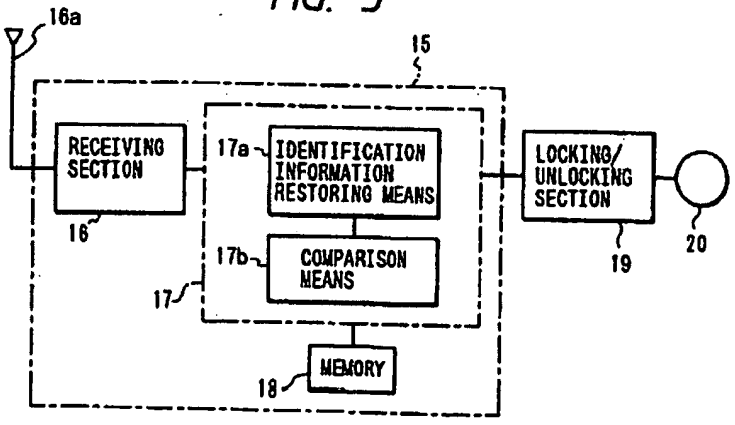


FIG. 3



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IDENTIFICATION INFORMATION TRANSMITTER/RECEIVER SYSTEM

Description of **GB2254461**

2 2 ') 44,51 1 - IDENTIFICATION INFORMATION TRANSMITTER/RECEIVER AND

SYSTEM The present invention relates to an identification information transmission/reception system comprising a transmitter and receiver which are made to correspond to each other by specific identification information and to a transmitter/receiver for use in a remote-control operation, such as unlocking doors of an automobile, and, in particular, to a transmitter/receiver adapted to deal with theft.

Various locking/unlocking systems for permitting the locking/unlocking of doors of automobiles or the like by radio waves or the like have been proposed in the prior art. The following features are common to these various systems: there are specific transmitters and specific receivers, identification signals are transmitted from a specific transmitter, and a receiver compares this transmitted identification information with its own identification information. If the identification information transmitted from the specific transmitter matches that of the specific receiver in this comparison being carried out, each of the sections of the receiver side is operated.

Some transmitter/receivers have a security function 2 having specific I/D codes. An example thereof includes a transmitter/receiver for remotely operating an automobile. A user of an automobile carries a transmitter, and transmission data having a unique I/D code added thereto are sent from this transmitter to the automobile. A receiver disposed in the automobile has a function to judge I/D codes. When the I/D code is judged to be the specific one, commands contained in the transmission data are executed, e.g., doors of the automobile are automatically unlocked or the inside lights or headlights of the automobile are turned on.

However, identification information itself to be compared is transmitted by the conventional system described above. Therefore, when persons other than the owner of the automobile try to steal and use the identification information, a problem has been unsolved in that. the identification information can be decoded relatively easily. Although it may be thought that, as the identification information is encoded, it would be protected against the above happening, the identification information can be decoded easily due to the regularity thereof even when such information is decoded.

When the transmitter/receiver using the above-described specific I/D code is used, on the other hand, there is a danger that, for example, the owner of the automobile will lose the transmitter or that the transmitter is stolen. If the person who found or stole the transmitter transmits signals in turn, for example, to a plurality of automobiles parked in a parking lot, an automobile corresponding to the transmitter can eventually be found, and the doors of that automobile can be opened.

Accordingly, an object of the present invention is to provide an identification information transmission/reception system from which identification information is not easily stolen and decoded, and which therefore provides increased security.

Another object of the present invention is to provide a transmitter/receiver having increased security in such a way that when another person has a transmitter, the transmitter is not necessarily set in a state ready to receive signals.

In order to achieve the above-mentioned objects, the present invention in one aspect pertains to an identification information transmission/reception system comprising storing means of the transmission side for storing identification information indicating a corresponding relationship between a specific transmitter and a specific receiver; computing means for reading out the stored identification information and for performing computation operations thereon; transmission data creating means for creating transmission data by adding the information on the number of computing operations thereto as - 4 well as the computed identification information; a transmitter having a transmitting means for transmitting the transmission data;

a receiver for receiving the transmission data transmitted from the transmitter; storing meansof the reception side for storing its own identification information; identification information restoring means for restoring the identification information before the computing operations have been performed; and a receiver having a comparing means for comparing the decoded identification information with its own identification information.

The present invention in another aspect pertains to a transmitter/receiver, wherein the transmitter comprises an operation section; a data creation section for creating data consisting of fixed codes, variable codes corresponding to the number of operations of the operation section, and transmission data; a modulation section for modulating the data; and a transmission section for transmitting data, and the receiver comprises a receiving section for receiving transmission data transmitted from the transmitter; a demodulation section for demodulating the received data; and a data decoding section, and wherein the data decoding section judges whether the data should be received on the basis of the fixed and the variable data and causes the code of the number of receptions to jump and be updated according to the variable code in accordance with a predetermined operation of the transmitter when the variable code does not match the code of the number of receptions.

The operation of the present invention constructed as described above will now be explained. When identifcation information is transmitted, a computing operation is performed. After the computed identification information and the number of computing operations are coded as transmission data, this data is transmitted.

The receiver decodes the received, coded transmission data and the restores identification information before the computing operation has been performed according to the number of computing operations contained in this transmission data. In this way, identification information is not easily stolen and used.

In the above-described means, data containing a variable code corresponding to the number of operations is transmitted from the transmitter, and the receiver accepts the transmission data when the fixed data matches that of the transmitter and the above-mentioned variable code matches that of the number of receptions. Therefore, when another person transmits to the receiver after he/she has operated the transmitter several times, the transmission data is not accepted because the variable code does not match that of the number of receptions. When an owner himself transmits to the rceiver after he/she has erroneously operated the transmitter several times, the number of receptions of the receiver is caused to jump and updated, and the data is accepted. This predetermined operation is to transmit a predetermined number of times, for example, three times in succession when, for example, the first transmission data is not accepted by the receiver. This operation permits the receiver to accept the transmission data.

The aforementioned and other objects, features and advantages of the present invention will become clear when reference is made to the following description of the preferred embodiments of the present invention, together with reference to the accompanying drawings, v/k-c; Fig. 1 is a block diagram which illustrates the construction of a transmitter according to a first embodiment of the present invention; Fig. 2 is a view which illustrates the contents of transmission data transmitted from the transmitter shown in Fig. 1; Fig. 3 is a block diagram which illustrates the construction of a receiver; Fig. 4 is a flowchart which illustrates the operation of the transmitter; Fig. 5 is a flowchart which illustrates the operation of the receiver; 7 Fig. 6 is a block diagram of a transmitter/receiver of a second embodiment of the present invention; Fig. 6(A) shows the transmitter and Fig. 6(B) shows the receiver; Fig. 7 is a view which illustrates the structure of transmission data; and Fig. 8 is a view which shows the relationship between the number of transmissions and the acceptance of receptions.

A first embodiment of the present invention will be explained below with reference to the accompanying drawings. Figs. 1 to 3 show, as an example, the structure of an unlocking system used in an automobile using an identification information transmission/reception system. Fig. 1 is a block diagram which illustrates the construction of a transmitter according to a first embodiment of the present invention; Fig. 2 is a view which illustrates the contents of transmission information transmitted from the transmitter shown in Fig. 1; and Fig. 3 is a block diagram which illustrates the construction of a receiver.

A transmitter 21 shown in Fig. 1 comprises a control section 10 formed mainly from a CPU serving as a control nucleus of this apparatus, a main memory or the like, a transmission section 11 serving as a

transmitting means for Fm-modulating signals generated by the control section 10 and 8 _.

sending out these signals as radio waves in UHF bands, an input section 12 for accepting transmission timing for transmission information from the transmission section 11, and a memory 13, composed of ROMs or the like, serving as a storage means in which application programs through which the CPU exhibits specific functions and identification information common to the transmitterand the receiver which makes a pair with the transmitter, which will be described later, is stored. Reference numeral lla denotes an antenna for transmission. The memory 13 may be composed of a RAM or the like in which information to be stored can be rewritten.

The control section 10 comprises a computing means 10a for performing computing operations on identification information read out from the memory 13 according to application programs, stored in the memory 13, from which specific computing operations are performed, and a transmission information creating means 10b for creating transmission information by adding the number of computing operations and the like to the result of the computation. The concrete structure of transmission information sent from this transmitter is as shown in Fig. 2.

The transmission data 14 shown in Fig. 2 is coded data, one transmission data being 13 bits long. The upper-order 8 bits of the transmission data 14 denotes rolling data 14a, the next 12 bits thereof denotes fixed data 14b, the next 4 bits thereof denotes operational data 14c corresponding to each of the sections of the unlocking apparatus equipped with a receiver, the next 12 bits thereof denotes the information 14d on the number of computing operations indicating the number of computing operations, the information of which is added to the identification information, and the last 12 bits thereof denotes checksum data 14e by which whether the transmission information has been received accurately is judged. The most significant 20 bits of the transmission data 14 denotes the identification information.

That is, in this embodiment, the identification information is formed of 20 bits consisting of the rolling data 14a and the fixed data 14b. The upper-order 8 bits (rolling data 14a) serves as a data area in which the contents change each time a transmission is performed. The rolling data 14a in turn change according to computing operations performed by the computing means 10a and the number of operations in accordance with the application programs, stored in the memory 13, by which the program's specific computing operations are performed.

Next, with reference to Fig. 3, an explanation will be given mainly with respect to the receiver. The receiver 15 shown in this figure comprises a receiving section 16 serving as a receiving means for demodulating data received from the antenna 16a, a control section 17 formed mainly from the CPU - serving as the control nucleus of this apparatus, a main memory or the like, and a memory 18 or the like in which are stored the identification information of this apparatus, application programs from which specific functions are shown by the control section, and reverse computing operation programs by which the computing operations stored in the memory 13 of the transmitter are performed reversely. An apparatus equipped with such receiver 15 has a locking/unlocking section 19 for locking/unlocking locks (door keys of an automobile or trunk room keys) which are connected in later stages.

The control section 17 comprises identification information restoring means 17a for restoring the identification information before the computing operation has been performed, and comparing means for comparing the identification information unique to the receiver 15 stored in the memory 18 with the decoded identification information according to the specific application programs stored in the memory 18 and according to the information on the number of computing operations contained in the received identification information. The control section 17 also has a function for sending out an unlocking signal to the locking/unlocking section 19 when the identification information of the receiver 15 matches the decoded identification information in the above comparison.

11 - The identification information restoring means 17a retrieves the rolling data 14a and information 14d on the number of computing operations of the identification information contained in the identification information shown in Fig. 2 and performs reverse computing operations on the rolling data 14a. That is, in this embodiment, the original identification information is restored by performing reverse computing operations on the rolling data 14a the number of times equal to the times which the computing operations have been performed.

The operation of the identification information transmission/reception system having a transmitter/receiver, constructed as described above, will be explained with reference to Figs. 4 and 5. Fig. 4 is a flowchart which illustrates the operation of the transmitter side. Fig. 5 is a flowchart which illustrates the operation of the receiver side.

First, the operation of the transmitter side will be explained with reference to Fig. 4.

In step 1, a check is made to determine whether the input section 12 has been operated. (in Fig. 4, step 1 is abbreviated as S1, and step 2, etc., are also abbreviated in the same manner) If it has been operated, the process proceeds to step 2. In step 2, the identification information is read out from the memory 13 and the process 12 proceeds to step 3. In step 3, the number of computing operations added to the read-out identification information is read out from the memory 13 and incremented by 1, and the process proceeds to step 4. In step 4, the incremented number of computing operations data is added to a predetermined position of the data to be transmitted, and it is written back in the memory 13. In step 5, a checksum is calculated, and the process proceeds to step 6 where this checksum data is added to a predetermined position of the transmission data. In step 7, a specific computing operation is performed on the incremented number of computing operations. The result of this operation becomes the rolling data 14a.

In step 8, the rolling data 14a is added to a predetermined position of the data to be transmitted. The process proceeds to step 9 where the transmission data is modulated and sent out in accordance with preset protocols.

Next, the operation of the receiver side will be explained with reference to Fig. 5.

In step 1, a check is made to determine whether transmission information has been received. If it has been received, the process proceeds to step 2. In step 2, a predetermined demodulation operation is performed, and the process proceeds to step 3. In step 3, a checksum is calculated separate from the checksum contained in the above- - 13 mentioned received data. In step 4, the checksum data contained in the received data is compared with the checksum data calculated in step 3. Then, the process proceeds to step 5 where a check is made to determine whether the two checksum data match each other. If they match, the process proceeds to step 6; if they do not match, the process returns to step 1.

In step 6, the identification information is decoded and the process proceeds to step 7. In step 7, the decoded identification information is compared with identification information unique to the receiver read out from the memory 18. Then, the process proceeds to step 8. In step 8, if a match is found in the comparison, the process proceeds to step 9; if a match is not found, the process returns to step In step 9, a predetermined unlocking operation is performed. The unlocking operation is determined according to the contents of the operational data 14c contained in the received data. Therefore, if switches corresponding to each of the sections of the automobile are provided in the input section 12, and operational information (for example, information on locking/unlocking of doors, opening/closing of windows, or locking/unlocking of a trunk) corresponding to these switches are stored in memory or the like beforehand, each of the sections of an automobile can be operated remotely by selectively operating the switches of the input section 12.

In the identification information transmission/reception system described above in detail, the identification information itself is not transmitted, and computing operations are performed on part of the data and the data is transmitted. Therefore, even if another person tries to steal and use the identification information, it is quite difficult to decode it. Furthermore, because the identification information contained in the transmission data is different according to the number of computing operations involved, security can be increased considerably.

The present invention is not limited to the abovedescribed embodiment. Various changes and modifications may be made without departing from the spirit and scope thereof. Although in the above-described embodiment, an example in which this system is applied to an automobile has been explained, the present invention has noted advantages also in the locking/unlocking of doors of vending machines and the like.

Although the identification information is obtained by the receiver by reversely performing computing operations on data received according to the number of computing operations, it is also possible that the identification information stored in the receiver itself is computed a 15 number of times equal to the number of computing operations of the transmission information in order to compare the computed data with the received data (rolling data).

Next, a second embodiment of the present invention will be explained with reference to the accompanying drawings.

Fig. 6 is a block diagram which illustrates a transmitter/receiver of the present invention; Fig. 6(A) shows the construction of the transmitter and Fig. 6(B) shows the construction of the receiver. A case in which the transmitter/receiver is used in a remotely controlled apparatus for automobiles is shown as an example.

As shown in Fig. 6(A), a transmitter 101 has a key operation section 111 and a data creation section 112 for creating transmission data. The data creation section 112 forms serial transmission data in which a unique I/D code (a), a variable code (b) and command data (c) are arranged, as shown in Fig. 7.

The I/D codes (a) are stored in the I/D code shown in Fig. 6(A). These codes (a) can also be mounting diodes at desired positions on a matrix memory 113 formed by circuit. The variable codes (b) are created by a variable code addition section 114. The code addition section 114 adds the number of operations of the key operation section variable data "01", or 110211, or 110311, or 11... it, is The data creation section 112 has functions and created. for storing command data (c) corresponding to predetermined command data operated by the key operation section 111 and for selecting corresponding command data. Serial transmission data, in which unique I/D codes (a) and variable codes (b) are appended to the selected predetermined command data (c) shown in Fig. 7, is created by the data creation section 112.

A modulation section 115 and a transmission section 116 are disposed in the stages posterior to the data creation section 112. The transmission data, shown in Fig. 7, created by the data creation section 112, is FM-modulated by the modulation section 115, and the data is transmitted from an antenna 117 by the transmission section 116.

A receiving section 122 for receiving transmission data from an antenna 121 and a demodulation section 123 for demodulating received data are disposed in the receiver 102 shown in Fig. 6(B). A data decoding section 124, a section 125 for adding the number of receptions and an I/D code memory 126 are disposed in the stage immediately after the demodulation section 123.

The unique I/D codes which are the same as those stored in the I/D code memory 113 of the transmitter 101 are stored in the I/D code memory 126. The I/D code memory 126 can also be formed by mounting diodes in a matrix circuit. In the section 125 for adding the number of receptions, the number of receptions is added as 110111, 110211, 110311, '1 11, when the 17 data decoding section 124 judges that the received I/D code matches the I/D code stored in the I/D code memory 126.

The data decoding section 124 compares the unique I/D code (a) shown in Fig. 7 of the received, demodulated data with the I/D code stored in the I/D code memory 126, and compares the variable code (b) (code corresponding to the number of transmissions performed by the transmitter) shown in Fig. 7 with the code of the number of receptions added by the section 125 for adding the number of receptions. When a code match occurs, the data is accepted, and an operation corresponding to the command data (c) shown in Fig. 7 is recognized, and a predetermined operational command is issued to a drive section 127. In the drive section 127, unlocking of doors of an automobile, turning-on of inside lights and headlights of an automobile and the like are performed by a drive mechanism, such as solenoides, a motor or switches.

When the data decoding section 124 judges that the variable code (b) does not match the code added to the section 125 for adding the number of receptions though the unique I/D code (a) matches that of the received data when the transmission data is received the next time, the data is accepted when it is judged that the same transmission data has been received a predetermined number of times, for example, three in succession. The acceptance of the data at this time is performed by causing the number of additions of

- 18 the section 125 for adding the number of receptions to jump according to the variable code of the transmitter 101. - Referring to Fig. 8, decoding codes, in particular those of the transmission/reception operations by the transmitter 1 and receiver 2, will be explained in more detail.

Assume that the unique I/D code (a) stored in the I/D code memory 113 of the transmitter 101 is "12333". A variable code (b) of l'0111 is formed by the variable code addition section 114 by operating the key operation section 111 of the transmitter 101 during the first transmission. A variable code (b) of "01" is added to the position posterior to the unique I/D code (a) of "12333" by the data creation section 112. Furthermore, an operational command data (c) is added to form the transmission data shown in Fig. 7. This data is transmitted from the antenna 117.

Transmission data is received by the receiving section 122 of the receiver 102. The data is decoded bv the demodulation section 123 and sent to the data decoding section 124. In this case, the transmitted unique I/D code matches the I/D code stored in the I/D code memory 126, both codes being-111233311. Because it is a first reception of data, an addition code of 1'0111 is formed by the section 125 for adding the number of receptions. Thus, the I/D codes match and the variable code (b) and the addition code of the section 125 for adding the number of receptions match, both being 110111. Therefore, the data is accepted. The command data (c) is decoded by the data decoding section 124, and a predetermined operational command is issued to the drive section 127.

Next, when a second transmission is made from the transmitter 101 to the receiver 102, an addition is made once by the va riable code addition section 114 of the transmitter 101, causing the variable code to become "02". If this data is received by the receiver 102, an addition for the section 125 for adding the number of receptions is made once, and an addition code of "0211 is formed. As a result, the transmission data is accepted by the receiver 102 because the variable code (b) matches the addition code, both codes being 1,0211.

Next, assume that a transmitter is used seven times to a receiver of another automobile because, for instance, the transmitter is handed over to another person. If a transmission is made thereafter to an automobile in which the receiver 102 corresponding to the transmitter 101 is installed, the variable code added by the variable code addition section 114 becomes l'101' at this time. The data decoding section 124 of the receiver 102 judges that the I/D codes match each other, an addition is made once in the section 125 for adding the number of receptions, and an addition code of "03" is formed. As a result, the - 20 transmission data is not accepted because the variable code 110111 does not match the addition code "03" though the I/D codes match in the data decoding section 124.

By contrast, assume that a tenth operation of the above transmitter is by the original owner. In this case, the same operation of the transmitter 101 is repeated three times in succession. At this time, because the received variable code is 110111 in the data decoding section 124 of the receiver 102 and the addition data in the section 125 for adding the number of receptions is "03", the data is not accepted during a first operation (the number of operations is ten). The same transmission (the number of operations is 11) is made the next time, the data is also not accepted by the data decoding section 124, and the data decoding seetion 124 recognizes that the received variable code is "lll'. However, the addition code in the section 125 for adding the number of receptions at this time is "04". If the same transmission is made one more time (the number of operations is 12), the addition numeral of the section 125 for adding the number of receptions is caused to jump to 12 according to the variable code of the above l'0111 by a command from the data decoding section 124, and an addition code of '112" is created. As a result, the data decoding section 124 judges that the I/D codes match and further the variable code and the addition code in the section 125 for adding the number of receptions match, both codes being 111211, and the data is accepted. A predetermined operational command is issued to the drive. section 127.

When a received variable code does not match the_ addition code in the section 125 for adding the number of receptions as in the case of the tenth operation shown in Fig. 8, the condition for causing the addition code to jump is not necessarily three consecutive operations, but may be four or more consecutive operations. Concerning the condition for causing the addition code to jump, the same transmission operations need not necessarily be repeated consecutively. Data for causing a Dump may be appended anterior to the command data (c) by a predetermined operation, for example, simultaneously operating a plurality of keys of the key operation section 111 of the transmitter 101. When this data is

received, the number of additions of the section 125 for adding the number of receptions may be caused to jump to 1111" in the eleventh operation.

The transmitter/receiver of the present invention is not limited to usesin conjunction with an apparatus for remotely controlling an automobile. It can be used for other apparatuses requiring a security function, for example, an apparatus for remotely controlling the opening/closing of garages.

According to the present invention described above in detail, identification information cannot be easily stolen and used. Thus, an identification information transmission/reception system having increased security can be provided.

In addition, according to the present invention, when another person tries to make a transmission to a receiver after he/she operated a transmitter in another place, transmission data is not accepted, thus the security function can be increased. In the case of an original user, no problems arise for regular use because an addition code can be made to jump according to predetermined operations.

Many different embodiments of the present invention may be constructed without departing from the spirit and scope of the present invention. It should be understood that the present invention is not limited to the specific embodiments described in this specification. To the contrary, the present invention is intended to cover various modification and equivalent arrangements included with the spirit and scope of the claims. The following claims are to be accorded a broad interpretation, so as to encompass all such modifications and equivalent structures and functions.

1 K1606

IDENTIFICATION INFORMATION TRANSMITTER/RECEIVER SYSTEM

Claims of **GB2254461**

CLAIMS

An identification information transmission/ reception system, comprising; a transmitter comprising; storage means for storing identification information indicating a corresponding relationship between a specific transmitter and a specific receiver; computing means for reading out the stored identification information and for performing computation operations thereon; transmission data creating means for creating data to be transmitted by adding information regarding the number of computer operations thereto as well as the computed identification information; and a transmitting means for transmitting the data to be transmitted; and a receiver comprising; receiving means for receiving the transmission data transmitted from the transmitter; storing means for storing its own identification information; identification information restoring means for restoring identification information before the computer operations have been performed thereon; and comparing means for comparing the decoded identification information with its own identification information.

2. An identification information transmission/ reception system according to Claim 1, wherein the data transmitted consists of coded data which is a predetermined number of bits long, and the data has the identification information consisting of a variable data section whose contents are changed for each transmission and a fixed data section.

3. A transmitter/receiver, wherein the transmitter comprises an operation section; a data creation section for creating data consisting of fixed codes, variable codes corresponding to the number of operations of the K1606 operation section, and transmission data; a modulation section for modulating the data; and a transmission section for transmitting data, wherein the receiver comprises a receiving section for receiving transmission data transmitted from the transmitter; a demodulation section for demodulating the received data; and a data decoding section, and wherein the data decoding section judges whether the data should be received on the basis of the fixed and variable codes and causes the code of the number of receptions to jump and be updated according to the variable code in accordance with a predetermined operation of the transmitter when the variable code does not match the number of receptions.

4. A transmitter/receiver according to Claim 3 wherein the predetermined operation is to transmit a predetermined number of times.

A transmitting/receiving apparatus substantially as hereinbefore described with reference to, and as illustrated by, the accompanying drawings.

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FIG. 1

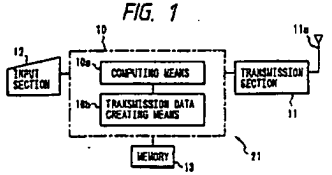

FIG. 2

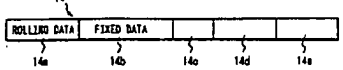

FIG. 3

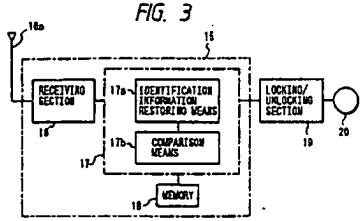

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FIG. 4

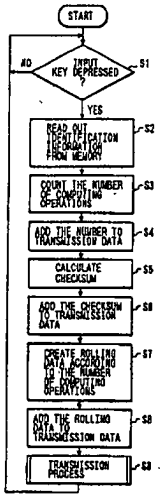

FIG. 5

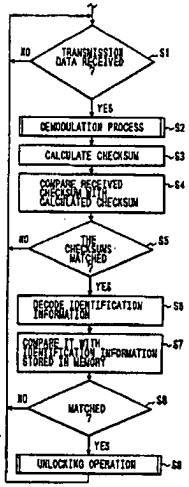

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FIG. 6(A)

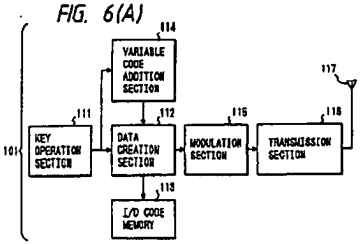

FIG. 6(B)

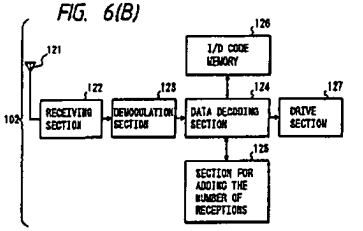

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FIG. 7

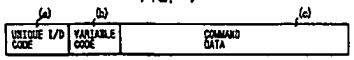

FIG. 8

TRANSMITTER 101			RECEIVER 102		
NUMBER OF OPERATIONS	I/D CODE (a)	VARIABLE CODE (b)	I/D CODE	ADDITION CODE	DECISION
1	12333	01	12333	01	OK
2	12333	02	12333	02	OK
3	12333	03			
4	12333	04			
5	12333	05			
6	12333	06	NOT RECEIVED		
7	12333	07			
8	12333	08			
9	12333	09			
10	12333	10	12333	03	NG
11	12333	11	12333	04	NG
12	12333	12	12333	12	OK

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